

in the muscle. Placing the fresh-cut end of the nerve in a saturated solution of common salt brings about a series of contractions in the muscle. The muscle also contracts when the nerve is stimulated with

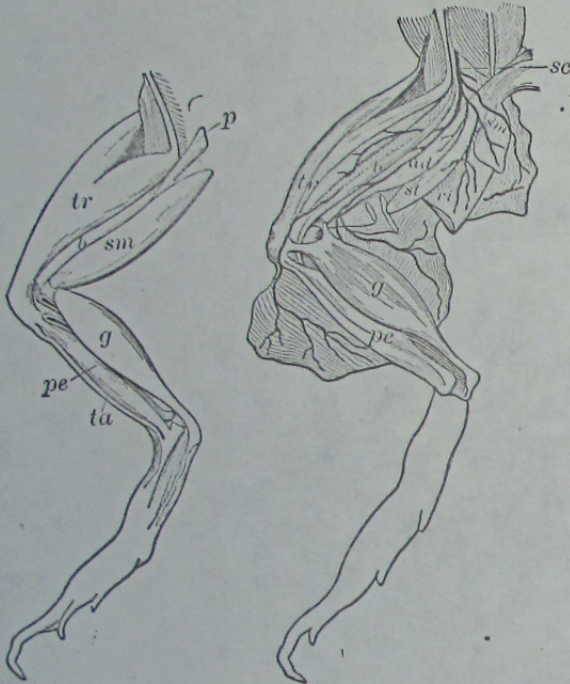


Fig. 7.

Fig. 8.

Muscles of the left leg of the frog. Fig. 8 shows distribution of the sciatic nerve.

- | | |
|------------------------------|-------------------------|
| ad M. adductor magnus. | sc sciatic nerve. |
| b M. biceps. | sm M. semimembranosus. |
| g M. gastrocnemius. | st M. semitendinosus. |
| p M. pyriformis. | ta M. tibialis anticus. |
| pe M. peroneus. | tr M. triceps. |
| ri M. rectus internus minor. | |

of cells which have no fixed form nor definite shapes. The red blood corpuscles of the frog are cells in which the nucleus can be easily discerned by aid of the microscope (Fig. 4, p. 16).

a weak electric current. If the nerve muscle preparation be placed on a copper plate, and the temperature of the latter be raised above or lowered below the normal, there will occur variations in the response of the muscle to stimuli. (Electrical stimulation will be found most convenient.) The relation of muscular action to temperature will thus be strikingly represented. These experiments with the nerve-muscle preparation show that the living substance is *irritable, unstable, and conductive* of stimuli.

5. *Cells.* — The amoeba and the white blood corpuscles already studied furnish very good examples

CHAPTER II

TISSUES AND ORGANS

10. The human body, beginning as a single cell, is gradually built up by a process of division and subdivision of that cell, so that the complete, adult man is but a mass of cells with some cementive and connective matter. It is found, however, that differences early appear in the characteristics of different cells, and these differences increase as development proceeds. *A group of similar cells having a similar function is called a tissue.*

11. *Differentiation of Tissues.* — In the lowest animals, composed of but a single cell, all the different parts of the body are essentially alike (leaving the nucleus out of consideration) and have the same functions. One part may move as well as another. All parts share in the process of nutrition, and one part responds as well as another to stimulus. But the higher animals are found to be made up of unlike parts, which minister in different ways to the life of the whole being. As the cells multiply, certain groups of cells become changed in such a manner as to adapt them to the performance of some special function, while other parts are adapted to other functions. A number of cells lying together become modified so as to make up a tissue adapted to a certain purpose. Other cells become modified in a different way to form a tissue adapted to a different

best way, to think pure and unselfish thoughts, to cherish the loftiest and noblest aspirations, is the most important business of youth. Manhood prepared by such training is ready for grand achievements. The spinal cord and the lower brain centers have been drilled to prompt and accurate reflex action, and much of the mechanical labor of life is left to their unconscious ordering. Not only are the ordinary movements of the body in walking, riding, and the various athletic sports thus directed, but facility and correctness of speech, both oral and written, have become no longer matter for cerebral care. Rapid writing, attended by accuracy in respect to the accepted forms and rules of composition, has been acquired by thorough training, and the brain is left free to concentrate all its powers upon the higher activities of thought and imagination. That the products of those activities shall be worthy is determined by the abundant store of memories of worthy and beautiful objects, acts, purposes, and thoughts. Noble deeds will be inevitable because of the constantly repeated, voluntary turning of nervous impulses into channels for such results. Acts demanded by great and sudden emergencies, when deliberation and reason are impossible, will be unselfish, wise, and every way worthy, because previous voluntary action has habituated all the nerve centers so to respond to stimuli received when judgment and reason have had time to consider.

471. Heredity.—Did each individual come into the world with all his powers in their normal condition, and grow up in the most favorable surroundings, such symmetrical and perfect manhood might be the expected and ordinary result. Unhappily that is not the case. Many eminent men of science believe that the impressions made upon the soft substance of a man's brain in early life are

so deep and lasting that they not only persist throughout the individual life, but also affect the brains and nerves of his children, and his children's children, so that they may have from their birth tendencies to act as their parents or their grandparents have been accustomed to act. They inherit a certain kind of *nervous temperament*, we say, and their nerve cells have a natural readiness to respond in certain ways to the influences which come to them. This may be a powerful aid to the development of upright and noble character, and it may be an almost irresistible force urging in the opposite direction. It has been observed in many cases that the children of criminals become criminal for generation after generation. The inherited *bent* of their minds appears to be evil, and as a rule their surroundings and associations are also evil. The power of a bad inheritance may, however, be neutralized by a good environment.

472. Influence of Alcohol on the Nervous System.—While the excessive use of alcoholic drinks works injury to every part of the body, it is largely through the direct effect of alcohol upon nervous tissue that the various evils are accomplished.

We will consider the physiological influence of alcohol on the nervous system under two heads: (1) *acute diseases caused by alcohol*; (2) *chronic diseased conditions*. Afterward the *moral* effects will receive attention.

473. Dipsomania (an acute disease) is the name given to the morbid craving for alcohol which renders a person utterly irresponsible for his acts while engaged in the mad pursuit of that which he believes will satisfy his consuming thirst. It is a distinctly diseased condition of the nervous system, and may result from what is only a slightly excessive use of alcoholic liquors by the sufferer himself, or it

may be due to a diseased state of nervous tissue inherited from an ancestor accustomed to such use, though he may never have indulged to the extent of intoxication. This form of alcoholism is now considered and treated as a disease by medical rather than moral methods.

474. Another acute form of alcoholism is called *delirium tremens*, and this is so terrible to witness, so frightful to suffer, that men speak the very name with bated breath. It occurs in persons whose nervous systems have been for a considerable time under the poisonous influences of excessive amounts of alcohol. At the height of the attack the patient becomes a raving maniac, subject to the most torturing illusions and sometimes, with the unnatural strength of madness, overpowering and escaping from several attendants. Repeated recurrence of the disease is almost certain to be fatal, though the first attack is rarely so. Permanent insanity may precede death.

475. Chronic Diseased Conditions arise from the gradual poisoning of the system by the continued use of beverages containing alcohol. Even though we admit that alcohol in a definite small amount is, in some cases at least, fully oxidized in the body, like other carbohydrates, and so supplies energy as food, we must never forget that different constitutions may be differently affected, and conditions as to climate, temperament, and habits of life may cause variations in its influence upon health and character. We can never know perfectly the nature of all the innumerable strains of hereditary tendency which unite to make an individual what he is. Some one of these may have impressed upon the nerve cells an instability, a weakness, a peculiar susceptibility to the influence of alcohol, so that the first taste may arouse the insatiable craving which leads to dipsomania. In another case, the inherited weak-

ness may render the child of an inebriate an epileptic, an imbecile, or a consumptive. We can never foresee just how the transmitted nervous weakness will manifest itself, but as a rule the descendants of those whose systems are poisoned by alcohol are enfeebled in body or mind or both.

476. But suppose a man to have derived from his ancestors a sound constitution and to have become addicted to the moderate use of alcohol; the insidious nature of the dangerous substance may gradually lead him to consume, insensibly perhaps, only a little more than the cells can oxidize. Without realizing it, he may slowly poison his system. The primary effect is upon the brain; there is congestion and overexcitement of the nerve cells there—conditions which gradually extend to the nerve cells of the spinal cord; inflammation sets in, and there follows fibrous degeneration of the tissues, substituting an inferior form for the specialized tissues which do the work of the organs in various parts of the body. Paralysis may result, or epilepsy, or dyspepsia from lack of the due amount of nervous influence upon the digestive organs, or any one of a thousand forms of disorder, some of which have been mentioned in preceding chapters. Though a man may never drink to intoxication, and never realize that he is using alcohol to excess, he may nevertheless become seriously diseased in consequence of his moderate indulgence, or what he believes to be such, while wondering why he is not well and strong. Still less does he consider the legacy of evil which he may be laying up for his children.

Life insurance companies have gathered an immense body of statistics respecting human life, with sole reference to their bearing upon the business of insurance, and

it is well known that life insurance companies regard policies upon the lives of drinking men—even “moderate drinkers”—as involving “extra risk.” Their figures have convinced them that the man who uses no alcoholic beverages is likely to live longer than one who does.

477. Many believe that *climate* has much to do with the influence of alcohol on the nervous system. Our American climate is peculiarly stimulating to the nerves, and our systems are, in consequence, less able to bear the additional stimulation of exciting beverages, while the narcotic effects take place more readily than in other climates, and self-control is more easily overthrown. This is another reason, to us, for shunning the acquisition of the alcohol habit.

The influence of *race* has also to do with the prevailing use of strong drink and its evil effects. The Teutonic peoples are recognized as especially susceptible to the taste for intoxicants, perhaps because of their eager craving for excitement, for action, for enterprise; and because of that very craving they can indulge with less safety the appetite for stimulants.

478. **The Moral Effects of Alcoholic Poisoning** concern the individual himself, his family and friends, and the whole community of which he is a member.

The struggle of life grows more intense the world over; competition in all lines of effort is keener; success is more difficult. Every one has need of all his powers of mind and body at their highest possible level of efficiency. A man engaged in business needs every day and hour the use of the very best and most careful judgment, lest a false step—the buying of goods at the wrong time, the selling at the wrong price, a mistake as to quality or style, a wrong estimate of the tendency of the market—may

give his competitors an advantage and lead to his own ruin. In the professions it is no less true that no man should dare run the risk of befogging his judgment. A physician known to be a tippler will lose the best practice; the lawyer whose legal advice is sometimes cloudy, because of a trifle too much alcohol in his morning dram, will not command the confidence of those wishing counsel.

A man seeking employment is likely to be met at every turn by questions as to his habits respecting beverages containing alcohol and his use of tobacco. Several of the great railroad corporations employ only total abstainers in any capacity. Purely from pecuniary considerations they cannot afford to run the risk of accident upon their roads,—involving destruction of the property of the road, with also many thousands of dollars to pay for life and limb destroyed,—because perhaps a brakeman, having taken a “drop too much,” was a little uncertain in his vision and did not grasp as quickly as usual the meaning of the signals; or because a telegraph operator had fuddled his brain with beer and had forgotten to send the dispatch which would have prevented a frightful wreck. So in respect to positions in the great commercial houses where trustworthiness, alertness, stability of character, are required;—it is those who drink neither brandy nor beer who stand the best chance, other things being equal, of securing desirable positions. In practically every walk of life a man is handicapped in the race if he is believed to be a drinking man.

All these facts clearly indicate the opinion of the world in general that, considered merely as a piece of mechanism for accomplishing various sorts of work, a man who takes no alcohol into his machine is worth more than one who does; so that a man who drinks thereby deliber-

ately lowers his own money value to the world and to himself.

479. But there are higher considerations than these. Alcohol in small quantities stimulates the cells to vigorous action for a time; then reaction and weakness may follow. In larger quantities alcohol produces, instead of a stimulating effect, a *narcotic* poisoning which paralyzes the nerves. This is first apparent in the higher cerebral centers, and if the poison is sufficient in amount, the paralysis extends till the whole voluntary portion of the nervous system is involved, leaving only the centers controlling the vital functions unaffected. The first glass of liquor may simply render a man unusually lively, talkative, perhaps brilliant, eloquent, entertaining, confidential, speaking freely of private affairs, revealing secrets. This stage will pass away before long, and if another glass is taken, and another, a progressive paralyzing of the mental faculties is seen. The ready flow of language disappears, utterance becomes thick, and ideas confused, stupor comes on, and the man falls to the floor "dead drunk," though circulation and respiration still go on. If he has taken alcohol *enough*, these too will cease, from the paralysis of the vital centers, and the victim will die. Occasionally a man runs through this course in a single debauch, but such cases are rare. Usually years of progressive deterioration precede the great catastrophe. The man's friends look on in helpless anguish. Noble manhood gradually sinks to the level of the beast, and below even that. He who was designed to be a mighty power for good to himself and to the world, becomes a curse to himself, a disgrace and a terror to his family and a burden to the community, which must employ police to watch him, build a hospital

or a prison to receive him, and must finally bury him at public expense and care for his unfortunate family. How is it that a being endowed with reason can deliberately put an enemy into his mouth to steal away his brains, and ruin body and soul?

Because one man whom we chance to know drinks daily a small quantity of wine or beer, and does not acquire that craving for more which leads to drunkenness, nor apparently injure himself in any way thereby, it is never safe to conclude that another man can do likewise. Nothing is more uncertain. At the same time it is a fact of common observation which no one will deny, that multitudes make shipwreck of manhood every year through the excessive use of alcohol; yet no one of them expected to be more than a "moderate drinker," not one but would have scorned the suggestion that he might in time become the vile drunkard of the gutter.

480. There is one infallible way of escaping these ills, and there is but one. That is to abstain wholly from alcoholic beverages. It is also a harmless way; it can do injury to no one. While it insures a man against the frightful evils of drunkenness, this course also makes it possible that by the force of his example he may help many a weak, tempted fellow-man to escape the seductions of the wine cup.

It may be an admirable thing for a man to be able to exercise the judgment, the self-restraint which permits him to indulge his appetite for alcohol to exactly that extent only which he believes to be harmless or helpful to himself, never yielding to a temptation to exceed the self-imposed limit. Is it not yet more admirable for a man to recognize the weakness of human nature, and the possibility — shown every year by thousands of sorrowful

instances — that even the manhood which seems strongest may be overcome, and so refuse to take the fearful risk of placing himself within the power of so insidious a foe? Does not the truest courage lead a man to avoid venturing needlessly and recklessly into the presence of so terrible a danger? And should not a man of really noble character deliberately choose to make his influence helpful, rather than harmful, to those weaker than himself?

481. Other Narcotics in Common Use. — Narcotics are very widely used by the human family for the relief which they give from pain or fatigue, or for the direct pleasurable sensations which they impart. All are deadly poisons when taken in sufficient quantities. Those most common (after alcohol) are *tobacco* and *opium*.

It has already been shown that tobacco may affect unfavorably many parts of the system, and is especially injurious to the young. It stimulates in small quantities and narcotizes in larger ones, working its effects directly upon the nervous system. *Nicotine* is a powerful poison found in tobacco. It affects the nerve cells, injures the brain, and leads especially to weakness of the heart by interfering with its supply of nervous force. Many cases of cancer of mouth and throat are believed to have resulted from tobacco smoking.

Opium, for its benumbing influence upon the nerves, is used by large numbers of persons, especially in Oriental lands. Its continued use deranges all the digestive processes, disorders the brain, and weakens and degrades the character. Like alcohol, it produces an intolerable craving for itself, and the strongest minds are not proof against the deadly appetite.

482. Self-control versus Appetite. — Man is a bundle of appetites. Every organ, every cell even, craves its appro-

priate stimulus. Animals under natural conditions gratify the appetites as they arise only to that extent which is healthful for the whole body. Man alone, whose highly developed brain is overlord to the rest of his system, permits an unwholesome indulgence of appetite to interfere with this general well-being. Alcohol, opium, and their like are far from being the only substances whose excessive use injures the organism and degrades character. Children are often allowed to indulge a natural fondness for sweets to an extent which is ruinous to digestion; for sugar, which is a useful and necessary food in suitable quantities, becomes in larger ones a poison to the system. Boys pampered with dainties from infancy logically infer that a fancy for cigars or beer may be similarly gratified. Appetite for even the most wholesome food may be in excess of bodily needs, and the practice of gluttony is certain to derange nutrition.

A child should be early taught that because he "likes" a certain article of food he should not therefore continue to eat it after natural hunger is satisfied, or at times when he does not need food; while to persist in eating or drinking that which experience, or the advice of those competent to judge, has taught him to be harmful, should be regarded as unworthy a rational being.

These are but illustrations of the manifold forms of intemperance which work untold harm to the physical and moral natures. There seems no possibility of improvement to our race except as the young are led to recognize the manliness and dignity of controlling one's appetites.

483. And it is not in respect to the delights of the palate only that a foolish self-indulgence prevails. The love of selfish pleasure in any form may be developed

till it encroaches upon the general well-being. Man's reason was designed to dominate all the appetites, to gratify them only so far as will conduce to the best use of the higher capacities. If the mind does not rule and restrain the appetites by the dictates of reason, then the body and not the mind is on the throne, and man sinks to the level of the beasts that perish. Temperance in all things, a wise moderation according to reason and experience, subordination of the appetites and passions of the physical being to the nobler requirements of the spiritual nature, and to the still finer sentiment of unselfish consecration of all one's powers to the service of humanity — these are the principles which dominate the highest type of manhood.

PART V

THE PRESERVATION OF HEALTH

CHAPTER XXIV

HEALTH AND DISEASE

484. Health, in man, is that condition of the organism in which all the various parts composing it perform their functions perfectly, so that the largest amount of the best work of which the being is capable is performed easily and without discomfort. Health is attended with a feeling of buoyancy, vigor, and happiness. Disease is the result of disordered action in some one or more parts of the organism, usually long-continued and affecting more and more the various vital processes.

Many of the ways in which persons are accustomed to injure the health by inattention to hygienic rules, or by violations of them, have been alluded to in preceding chapters. Incorrect habits of life are the direct cause of many diseases, and indirectly cause many more by weakening the organs, and preparing the system to yield readily when exposed to the influences of specific disease.

485. *Bacteria*. — It is now known that several forms of disease arise from the growth and multiplication, within the body, of certain microscopic forms of life called bacteria, or bacilli, or microbes, or germs. These are living

Vis'ce-ra (Lat., plu. of *viscus*, perhaps akin to Eng. *viscid*): the organs contained in the abdomen.

Vital knot: the nervous center in the medulla oblongata which presides over the coördination of the respiratory movements. If the medulla be divided below this center respiration ceases and death results.

Vit're-ous humor (Lat. *vitreus*, of glass): the jellylike substance filling the posterior chamber of the eyeball.

Viv-i-sec'tion (Lat. *vivus*, living, and *sectio*, a cutting): dissection of a living body.

Vo'cal cords (Lat. *vox*, *vocis*, voice): bands of elastic tissue in the mucous membrane of the larynx which act upon the air like the reeds of a musical instrument to produce musical sounds.

Vo'mer (Lat., a plowshare): a small bone forming part of the partition between the nostrils.

Yellow spot: an area about one twenty-fourth of an inch in diameter in the retina of the eye, upon which the most definite images are formed.

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